

In Commemoration of the Bicentennial of the Birth of

C A R L W I L H E L M S C H E E L E

GEORGE URDANG

*Director of the American Institute of the History of Pharmacy,
Madison, Wisconsin.*

Two hundred years ago, on December ninth or nineteenth 1742—the exact date is disputed—Carl Wilhelm Scheele was born. On the twenty-first of May 1786 he died. Between these dates lies one of the most decisive periods of political history as well as of scientific history. As to political history the idea of democracy grew, more or less violently, into the realm of reality. As to scientific history the esoteric discussion of the abstract was superseded by the democratic search for the concrete. Theories were not to be imposed upon the facts any more but to be derived from them. The deductive and the inductive methods of research had finally changed their roles during this period.

It was this general situation which made the work of Scheele especially important. Here was a man to whom speculation meant nothing and the discovery and honest presentation of facts everything; one of the rare empirics whose special kind of genius enables them to put the right questions to the right subjects and to obtain the most surprising results in the most simple way and with the most simple apparatus.

Nothing in the early life of Carl Wilhelm Scheele indicated his later greatness. He was born in the then Swedish City of Stralsund (Pommerania) as the seventh of the eleven children of the brewer and later broker Joachim Christian Scheele and Margaretha Eleanora nee Warnekros(s). Two years later his father became bankrupt. There was neither much time nor much money to be devoted to the education of the boy whose shy and reserved behavior did not betray special talents anyway.

At the age of fourteen Carl Wilhelm Scheele left the private school which he had attended for eight years and decided to become a pharmacist. This decision proved to be of the greatest benefit to himself, to pharmacy, to chemistry and finally to the world at large. In spite of the most alluring offers made to him in later years, Scheele remained with pharmacy all his life. All his investigations and discoveries were made in the Swedish pharmacies in which he worked first as an apprentice and then as a clerk and finally in his own pharmacy in the small Swedish town of Köping. It can be assumed that it was the example of his older brother Johann Martin, born on February 14, 1734 and died on January 15, 1754, that influenced the boy's decision. This seems the more likely as Carl Wilhelm became an apprentice to the same man to whom his deceased brother had been apprentice, i.e., to the apothecary Martin Andreas Bauch, the owner of the pharmacy at the Unicorn in Gothenburg.

Now the latent talents and energies of the young man began to develop. He found himself surrounded by substances the real nature of which was not or merely incompletely known and which he could investigate and experiment with as he pleased, pushed by no one and responsible only to himself. His master, recognizing the unusual zeal of his apprentice, not only encouraged Scheele's scientific curiosity in granting him the material needed and as much time as possible, but in addition put his well equipped library at his apprentice's disposal. It was especially the German apothecary Caspar Neumann's "Praellectiones Chemicæ" and the "Cours de Chimie" of the French pharmacist Lemery which young Scheele made subject of an intensive study and which formed the basis of his early experiments. It was during the eight years of his stay in Gothenburg (1757 to 1765) and the following three years of clerkship at the Pharmacy at the Spotted Eagle at Malmö (1765 to 1768) owned by the apothecary Peter Magnus Kjellström that Scheele laid the groundwork for most of the discoveries which made him one of the greatest chemists of all time.

Anders Jahan Retzius, who became acquainted with Scheele at Malmö and was the first scientist to recognize—and to take advantage of—the genius in the young apothecary clerk, described his young friend in a letter written about twenty years later (1786) to Wilcke as follows:

“His (Scheele’s) genius was given to him exclusively for physical science. He had absolutely no interest in any other. It is doubtless for this reason that his talents seemed to be poor if other matters were concerned. His memory was excellent. However, this too seemed only fitted to retain matters relating to chemistry. During his stay at Malmö he bought from Copenhagen as many books as his small pay enabled him to procure. These he read through once or twice. Then he remembered all that he desired to recall, and never again consulted the books. Without systematic training and with no inclination to generalize, he occupied himself mainly with experiments. From the time of his apprenticeship at Gothenburg he had worked several years without plan and for no other purpose than to note phenomena; these he could remember excellently. Eleven years’ continuous exercise in the art of experimenting had enabled him to collect such a store of facts that few could compare with him in this respect. In addition he had gained a readiness in devising and executing experiments such as is rarely seen. He made all kinds of experiments, so to say, pell-mell. This taught him what many a doctrinaire could never learn: since working by no formulated principles he observed much and discovered much that the doctrinaire would consider impossible, in as much as it was opposed to his theories. I once persuaded him during his stay at Malmö to keep a journal of his experiments, and, on seeing it, I was amazed not only at the great number he made, but also at his extraordinary aptitude for the art.”

A. E. Nordenskiöld in his book “Carl Wilhelm Scheele, Nachgelassene Briefe und Aufzeichnungen,” Stockholm, 1892, in editing Scheele’s “Laboratory Notes” made the following comment:

“These notes prove once more that the basic experiments for a large part of Scheele’s great discoveries have already been made at Gothenburg and Malmö, that already the apprentice had subjected to an exact investigation the entire material offered to a chemist in a pharmacy of his time achieving results which, if published immediately, would have made the years 1767-1770 a turning point in the development of chemistry.”

The statements of Retzius and Nordenskiöld, the one based on personal knowledge and the other on the laboratory notes of the great apothecary and the perspective given by a distance of

more than a century, are highly illuminating. They prove that the fact of Scheele's being a pharmacist was by no means incidental and negligible or even regrettable and detrimental to his research work as some of Scheele's biographers intimate. On the contrary, it was of greatest importance for the kind as well as for the amount of his achievements. It may well be said that it was the good luck of Scheele and of chemistry that Scheele was, first and above all, a pharmacist. Here and only here a vast variety of subjects offered themselves to his scientific curiosity. Here and only here he was given the independence of work and conclusion which he needed. It was the *apothecary* Scheele who, encouraged by Torbern Bergman but carrying on his experiments quite independently, became interested in black magnesia which interest resulted in the recognition of the individuality of manganese and baryta and the discovery of chlorine. It was the *apothecary* to whom the problem of Prussian blue offered itself leading to several important results among them the preparation of hydrocyanic acid, and whose daily contact with tartar brought about the discovery of tartaric acid, the first of the chain of organic acids isolated by him. The red mercury oxide from which Scheele gained oxygen as early as in 1771-72 was a much used *pharmaceutical* substance and it was a typical *pharmaceutical* procedure, the preparation of lead-plaster, which lead Scheele to the observation and isolation of glycerin. It was the needs of *pharmacy* which caused Scheele to look for an inexpensive way of preparing phosphorus and for a more convenient and less dangerous method of preparing calomel.

Although pharmacy was undoubtedly the basis of Scheele's chemical work, his being a pharmacist did not prevent him from solving chemical problems not offered within the frame of his profession. Sweden is a land of mining. Her mountains contain valuable ores. Scheele refused to leave pharmacy for a position in industry. He did not go to the mountains, but the mountains came to him. In materials sent to him he discovered molybdcic acid and tungstic acid and it was he who gave to industry the methods for the analytical separation of iron and manganese and for the decomposition of mineral silicates used for more than a century.

Until his early death at the age of only forty-three years

Scheele reported one discovery and observation after the other in such rapid succession that his contemporaries were almost overwhelmed. Thus Lorenz v. Crell, the renowned founder and editor of Crell's *Chemische Annalen* after having received the news about glycerin wrote to Scheele on December 2, 1783 as follows: "I am wondering what more will be disclosed by you! I dare to assume that no chemist is known to us who has ever made so many and so important findings. As soon as you have made another new discovery . . . please send it to me immediately without caring for postage. Your letters are not too expensive for me at any price."

This reverence paid Scheele by v. Crell was only one of the innumerable proofs of the high esteem in which the humble apothecary was held by his contemporaries. At the age of thirty-two, still being an apothecary clerk and not yet having passed the Swedish apothecary examination, Scheele was made a member of the Swedish Royal Academy of Science and thus given the highest scientific distinction Sweden had to offer. It was no less a person than the great Torbern Bergman who took pride in initiating the new member and to welcome Scheele as follows:

"For several years I was witness of your unrivalled industry, of your special talent to elicit the secrets of nature by purposefully arranged experiments, and of the ingenious conclusions that you have drawn. Hence what can be more natural than the particular joy with which a man like me, loving his science ardently, sees you take a place of honor to which your merit and nothing else has paved the way for you."

After the death of Bergman, J. C. Wilcke, then Secretary of the Swedish Royal Academy of Science, wrote in a letter to Scheele under the date of August 9, 1784 as follows: "Since we lost Bergman, it is you in whom we put the greatest confidence that you will keep up our (Sweden's and the Academy's) reputation as to chemistry."

The authority which Scheele enjoyed was so great, and his honesty and simplicity of character so obvious and disarming that none of the usual scientific jealousies and quarrels ever touched him. When his book on air and fire, due to the negligence of his publisher, appeared so late that some of his statements concerning oxygen were in the meantime made and pub-

lished by other authors, nobody dared to raise the question of plagiarism.

Naturally, the question as to the priority of the discovery of oxygen has been discussed again and again. It was not until 1892 that the publication of Scheele's correspondence and laboratory notes, presented to the world by the Swedish arctic explorer A. E. Nordenskiöld definitely proved that prior to 1773, that is at least a year before the date of Priestley's discovery, Scheele had prepared oxygen from the carbonates of silver and mercury, from mercuric oxide, nitre and magnesium nitrate, and by the distillation of a mixture of manganese oxide and arsenic acid.

According to Rosenthaler (*Ber. Deutsch. Pharm. Ges.* 1904) it was Scheele who for the first time consciously showed that it is possible and necessary to prepare systematically the plant-constituents as chemical individuals and that, for this reason, "Scheele and nobody else has to be regarded as the founder of modern plantchemistry." Since Scheele in 1783 prepared hydrocyanic acid from coal, ammonium chloride and potash, Ferchl-Süssenguth in their "Kurzgeschichte der Chemie," Mittenwald, 1936, give to him and not to Wöhler the credit to have been the first to perform an organic synthesis. Scheele employed and in 1782 recommended sterilization, and his observation that different parts of the solar spectrum influence the decomposition of silver chloride in very different degrees (1775) has been considered the beginning of spectral photography.

Scheele was so exclusively devoted to his science on the one hand and to his pharmaceutical service to his fellow citizen on the other that he literally had no private life. In his entire correspondence there is, besides not very frequent letters to his parents and brothers, hardly one note which is not devoted or does not refer to his work. There was never a woman in his life. The widow of the preceding owner of the pharmacy at Köping took care of his household for ten years. He married her three days before his death in order to secure for her the inheritance of his small fortune.

The profit drawn by a peaceful world from the discoveries of C. W. Scheele has been enormous. The work of this "corner druggist" has become a corner stone in the edifice of modern civilization. The bleaching and the laundry industry and wide

fields of chemical disinfection among them that of water purification are inconceivable without chlorine. The fruit acids discovered by Scheele are of highest importance for the modern foodstuff and beverage industries. Tungsten and molybdenum, to the discovery of which Scheele paved the way, are indispensable in modern steel industry, and glycerin, finally, belongs to our daily life commodities used for a multitude of purposes and in many industries.

In 1930 the Association of American Soap and Glycerin Producers sent to the Swedish Crown Prince a message felicitating him on the discovery of glycerin by a Swedish citizen. Today it would be up to the manufacturers of explosives using nitroglycerin as the basis of their deadly products to do the same.

In 1892 the committee for the erection of a Scheele monument at Stockholm stated in a public pronouncement that "Scheele contributed more to the development of the era in which we are living than diplomatic negotiations and pitched battles."

At the present time, fifty years later, we are once more in the midst of pitched battles. However, honoring nevertheless the memory of the great men of science and peaceful progress, the memory of men like Scheele, we are reminding ourselves and the world of what we are fighting for.

